Professor Bennett
From the author.

17

CASE

OF

COMMUNICATION WITH THE STOMACH,

THROUGH THE

ABDOMINAL PARIETES,

PRODUCED BY ULCERATION FROM EXTERNAL PRESSURE;

WITH OBSERVATIONS ON THE CASES OF GASTRO-CUTANEOUS FISTULÆ ALREADY RECORDED.

BY

CHARLES MURCHISON, M.D. Edin., L.R.C.P.,

ASSISTANT-PHYSICIAN TO KING'S COLLEGE HOSPITAL, AND TO THE LONDON FEVER HOSPITAL.

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Received 9th November.—Read 24th November, 1857.

In May of the present year, when on a visit to Aberdeen, I had frequent opportunities of seeing, and making observations on, the patient whose extraordinary case is detailed in this paper. She was then in the Aberdeen Royal Infirmary, under the care of my friend, Dr. W. Keith, the senior surgeon. I am indebted for the following details as to the patient's history to Dr. Keith, who has also kindly permitted me to bring the case before the notice of the Royal Medical and Chirurgical Society.

I have also appended to the paper a collection, arranged in a tabular form, of twenty-five cases of fistulous communications between the stomach and external surface, with some general observations deducible from these cases.

A. *Case of Catherine Ross.*

Catherine Ross, æt. 34 (born June 16th, 1822), a native of Aberdeen, was admitted into the Aberdeen Royal Infirmary, under the care of Dr. Keith, February 19th, 1857, with a large fistulous opening in the walls of the abdomen, situated between the scrobiculus cordis and umbilicus, and communicating in the freest possible manner with the interior of the stomach.

1. *Family history.*—Her father and mother are both alive. They have had five sons and five daughters. Two of the sons and two of the daughters died in infancy. She has a married sister subject to some convulsive affection, probably hysterical. She has also a brother afflicted with epilepsy, and an unmarried sister little better than an idiot. The parents themselves are in good health of mind and body—always sober and industrious.

2. *Previous individual history.*—This woman has on more than one occasion made herself noted by feigning diseases, so as to deceive her friends and medical attendants. In 1840, she was, for a period of three months, under medical treatment for hysteria in its most exaggerated form, being often convulsed and frequently cataleptic. She would pass eight, ten, or even fourteen hours in a seemingly unconscious state of mind, frequently conjoined with a constrained and unusual position of body. In 1844, after various attempts on her lower limbs, she succeeded in producing such a solid œdematous enlargement of the left upper extremity, as to deceive her friends, and mislead for two years more than one medical attendant, into the belief that she laboured under elephantiasis. During that period, severe and long-continued blistering was employed, and every conceivable mode of treatment had recourse to, with no perceptible alteration in the size of the limb. The cicatrices resulting from the blisters, becoming distended with effused fluid, and consequently rugged looking and elevated above the level of the surrounding skin, did more than anything else to complete the *vraisemblance* of actual elephantiasis. Wearied

out by a fruitless attendance, her medical advisers readily acquiesced in a proposal, emanating from herself, that the limb should be amputated at the shoulder-joint; and Dr. Keith was requested to see the case, with a view to her removal to the hospital. He pointed at once to the abrupt termination of the swelling at the insertion of the deltoid muscle, as demonstrative of an artificial enlargement; but as it would scarcely have been credited that the patient could, for two whole years, have kept up such a deception in the very midst of her family, no suspicion was betrayed in their presence, and she was admitted into a small ward of the Aberdeen Infirmary, on the 25th of August, 1846, the entry of her disease made in the Case Book being "Feigned elephantiasis." Being in the hospital at seven next morning, Dr. Keith walked suddenly into her ward, and found her hurriedly concealing a garter under her pillow. The fact of her having been in bed for two years, with no stockings on all that time, left no room to doubt that the garter had been tightly applied, at the insertion of the deltoid, on her left arm, by her teeth and right hand; and, accordingly, on exposing the arm, there was the deep sulcus, marked by the very ribbing of the worsted band. Dr. Keith gave her one chance, and promised not to expose the cheat, provided she would now consent to be cured: but in vain. She found means to strangulate the arm every night; so that, after a trial of three days, both her hands and arms were restrained in the sleeves of a strait waistcoat. After this, the cure advanced with great rapidity, and in five days the skin hung quite loosely upon the arm. The waistcoat was not removed for three weeks; indeed, not until her own entreaties, coupled with a promise of better behaviour, gave hope that she was wearied of deceit. On the 26th of October, 1846, after sixty-two days' treatment, she was dismissed cured; both arms being much alike; her spirits good; her mind active and intelligent; and she herself professing great gratitude for what she was pleased to designate "the wonderful cure!"

For two years after this she continued well, keeping

house for an uncle; when at length she took a fancy that she had heart disease, for which a surgeon inserted a seton in the vicinity of the scrobiculus cordis, and kept it open for some years. It was in November, 1853, that Dr. Keith again, and only by accident, saw her. The seton had at length ulcerated out; but he was told that the wound would not heal, and his opinion was asked. He examined a deep, round, fiery-looking ulcer, exactly midway between the umbilicus and the ensiform cartilage, of the exact shape and size of an old copper penny of the reign of George III, which she had very nimbly nipped out with her nail, along with the dressings. Dr. Keith warned her of her folly, and explained to her the risk she ran of ulcerating a passage into her belly, which might prove fatal. She evidently paid little attention to what was said, and Dr. Keith refused to take charge of the case. At length, after fully three years' pressure by a belt, of a copper coin over the ulcerating surface, she was seized with irritability of the stomach, bringing up bile and blood. Along with these symptoms, she had much fever for five days; and on one of these days, viz., March 2d, 1854, she discovered, on removing the dressings from the wound, that a piece of biscuit and a portion of orange peel, along with a quantity of fluid, escaped from the opening. For many days after, the whole food swallowed was discharged by the opening, and she became greatly exhausted. By the 23d of March, however, her own shrewdness taught her to fit a plug of gutta percha into the wound, so as actually to cork it up. This plug, somewhat enlarged on two subsequent occasions, as the opening has become a little larger, and kept *in situ* by a belt round the waist, has ever since sufficed to retain the great bulk of her food within the stomach, where it would appear to be well and quickly digested; her flesh, for a naturally spare person, being well kept up. Her general health has improved, and her hysterical symptoms have, for the most part, disappeared, from the period that the opening was established; she having now something special with which to occupy her mind and take up her

attention. After a delay of nearly three years, she sought admission into the hospital, as already stated, on February 19th, 1857, her professed wish being to have the opening closed.

3. *Observations on her condition while in hospital.*—She has jet-black hair and dark eyes, pale skin, prominent lips, melancholic countenance, and although spare, is not much emaciated. She has kept her bed for nine years; and consequently she is quite unable to walk or even to stand, and even feels faint and weak when she sits up in bed. There is no great stiffness of the joints, however, and the limbs are wonderfully well nourished; so that the chief reasons for her keeping her bed appear to be habit and her own dogged obstinacy.

In the epigastric, and upper part of the umbilical region of the abdominal parietes, is an oval opening communicating with the interior of the stomach. The long diameter is transverse, and measures four inches, the vertical diameter being about three inches. When the patient sits up or stands, or, even when reclining, if she coughs, or makes an effort as if to vomit, the walls of the stomach fall out through the opening, the whole organ becoming everted. She can take the stomach out, and push it in again, without feeling the slightest pain, even on free manipulation. Three fingers can be introduced into the cavity of the stomach with ease, and one of them passed down into the pylorus, or upwards into the cardiac orifice. She commonly keeps the opening closed by a gutta percha plug, covered with chamois leather and oil silk, and retained by a circular bandage. When this plug is removed, everything she swallows is almost immediately ejected through the opening, and even when the plug is *in situ*, some of the liquid portions of the ingesta ooze away by its sides, and, in a slight degree, irritate the surrounding skin. The margins of the opening, for some inches, are red, smooth, glistening, and tender. The mucous membrane of the stomach is of a bright vermilion-red colour, and occasionally bleeds a little, at isolated spots, when irritated. Although handling of the mucous mem-

brane and other irritating causes seem to produce no pain, they are always followed by a feeling of sinking and great faintness for a few minutes. A piece of blue litmus paper applied to the moist surface of the empty stomach, remains unaltered; but after food has been swallowed, or if the litmus paper is introduced into the pulpy food undergoing digestion, it is immediately turned red. The mucous membrane is disposed in rugæ, arranged longitudinally as regards the long axis of the stomach, but assuming a circular direction around the everted organ. Undulating movements may often be seen passing along the surface, which are increased by the contact of food. The edges of the opening are fully three quarters of an inch thick, red, and glazed; not at all ulcerated, but firmly cicatrized. The mucous membrane of the stomach appears gradually to lose itself in the surrounding skin, so that the margins of the opening are not unlike those of the human lip; and, indeed, the whole opening bears a coarse resemblance to a large mouth, half open.

Her tongue is clean and soft all day, but dry and parched towards night. She is usually very thirsty, and drinks a great deal of water. Her appetite is seldom at all impaired; and, at times, is so keen as to amount to pain. She often requires to swallow a piece of bread on the instant, to remove an unbearable feeling of sinking. She can eat and digest any kind of food, but she complains of pain at the pit of the stomach after eating solid food. Her preference is for eggs, and boiled fish, tea and bread, and vegetable soups. No pain follows the use of any of these; but she always feels great annoyance from the increase of irritation around the opening, owing to the escape of the fluid contents of the stomach, by the side of the plug, after each meal. She has only about one stool in the twelve days, consisting of numerous, hard, rounded scybala, like, but larger than, the droppings of sheep.

Her pulse is 80, regular, soft, and of fair volume. On auscultation there is nothing abnormal heard about the heart's sounds. The impulse of the heart cannot be dis-

tinctly felt from the stomach, on introducing the fingers and pressing them upwards, but the attempt to do this occasions considerable pain. It is very noticeable, however, how very close to the posterior wall of the stomach is the abdominal aorta, and how very immediately the tip of the finger meets its pulsation, when inserted into the opening.

Her respirations do not exceed twelve in a minute. She has no cough, nor any symptom of chest disease.

Her urine presents normal characters, but is rather scanty.

She has never been married, nor had any family.

She began to menstruate at the age of 14; and continued regular up to the time at which the opening in her belly took place. Since then the menses have entirely ceased. She has no leucorrhœa.

Her temper is placid, and she is affectionate to her parents. She at times has fits of crying, but not of laughing, as she once had; but, occasionally, "she flies off into a rapture," as her mother calls it. Her sleep is disturbed, but little seems to suffice: for a long time she has been in the habit of taking the equivalent of fully an ounce of laudanum a day. She is intelligent, and well informed for one in her station of life; she speaks rationally on every subject, but is silent when her own misdeeds are alluded to. She has never attempted self-destruction, but is calm in the prospect of death, and says she prays for it. Had she succeeded in her original wish of getting an arm amputated, so as to make herself an object of commiseration, and afford a sufficient excuse for living on her friends in perfect idleness, the probability is that she never would have fancied heart-disease and never have commenced the process of continuous pressure, by which, after a period of three years, she succeeded in safely effecting an entrance into her stomach. Three years of the consequences may have somewhat sickened her of the experiment, and when she sought admission into the hospital, it was, as already stated, with the professed object of having the opening closed. Dr. Keith was inclined to think that this

might be effected by bringing the edges together after effectual paring, provided that the patient was really wishful to have it so. But, after some delay to weigh the question, he came to the conclusion that she would render every such attempt fruitless. She has gained her point; lives an idle life; eats, drinks, reads a book, and is satisfied. She feels herself to be an object of great interest; and one has only to witness the perfect complacency with which she uncorks her stomach, allows her dinner to gush out, and invites a visitor to search with his finger for the cardiac or pylorie orifice, to be convinced, that however much she might relish the *fuss* of an active attempt to close the opening, she has no wish nor intention that it ever should be closed.

Some weeks ago I wrote to Dr. Keith, to inquire if Catherine Ross ever vomited, and if any observations had been made of the stomach during the act of vomiting. The replies which I received, with an account of a very interesting experiment undertaken by Dr. Keith, were to the following effect: at intervals of a month or two she has a feeling of nausea, accompanied by a burning sensation at the scrobiculus cordis; but this ends only in an escape of bilious fluid at the side of the plug. Prior to the formation of the opening she vomited very frequently; but, in a period of three years and seven months, *i. e.*, since the 2d of March, 1854, she has only about ten or twelve times brought up one or two mouthfuls of yellow-tinged mucus, and that only when the plug was in the opening. On the 30th of last October, Dr. Keith made the following experiment: the plug was removed, and as much of the contents of the stomach (consisting of vegetable soup recently swallowed) as the ordinary protrusion of the stomach would eject, were allowed to escape. The fauces were then tickled with a feather held in the patient's own hand. Immediately the whole remaining contents of the stomach were projected from the opening. This appeared to depend, in the first place, on a strong spasmodic contraction of the stomach itself, and principally of its pyloric extremity, for

there was squirted from the pylorus, as if from a syringe, about a teaspoonful of light yellow bile. Simultaneously, however, with this, the abdominal walls were observed to become rigid, and this became more apparent on continuing the irritation of the fauces; for the next effect was seen to be violent contraction of the recti and other abdominal muscles, producing complete and almost instant eversion of the stomach. This organ was turned fairly inside out, evidently owing to the downward pressure of the contracting diaphragm meeting the upward pressure of the contracting muscles of the abdominal parietes. The upper wall of the stomach, indeed, could be seen and felt to be pressed downwards by the diaphragm. After a few minutes the patient herself restored the stomach to its place, pushing it in with the gutta-percha plug; and within ten minutes she partook of another plate of soup, as if nothing had happened, feeling neither nausea nor pain from the recent experiment.

Of the numerous points of interest connected with this case, the most important is undoubtedly the circumstance of the existence of a fistulous communication with the stomach, existing for a lengthened period during life.[1] Every member of the profession is acquainted with the case of the Canadian, Alexis St. Martin; but few, I believe, are aware that the records of medicine contain accounts of many other such cases, resulting either from injury or disease; and that, in not a few instances, the patients have lived for many years with the open fistula. I have, therefore, been induced to make the following collection of cases of gastro-cutaneous fistulæ.

[1] I have had another opportunity (June, 1858) of seeing Catherine Ross, who is now living with her parents in Aberdeen. She is, on the whole, in better health than last year, having gained somewhat in flesh. Nothing will persuade her to leave her bed; but there appears little to prevent her, except her own perverse determination. The dimensions of the opening in the abdominal parietes have slightly increased.—C. M.

B. *A Collection of Cases of Gastro-cutaneous Fistulæ.*

The cases of fistulous communications with the stomach through the abdominal parietes, which I have been able to collect from the records of medicine and surgery during the last 300 years, amount to twenty-five. For the sake of brevity, I have arranged them in a tabular form, so as to illustrate the following points:

1. The date at which the opening occurred.
2. The patient's name and residence.
3. The patient's age.
4. The cause which gave rise to the fistula.
5. The situation and characters of the external opening.
6. The size of the external opening.
7. Situation of the opening as regards the walls of the stomach, and any other morbid appearances of this organ.
8. Observations made as to the escape of food from the opening.
9. Duration of the fistula, and its consequences — whether the patient died or was cured—and the effects on the general health.
10. A brief notice of any physiological observations made as to the appearance of the mucous membrane of the stomach, the movements of its walls, and the nature and properties of the gastric juice.
11. The names of the observers of the cases, &c.
12. References to published accounts of them.

A COLLECTION OF CASES OF GASTRO-CUTANEOU

No. of Case.	Date of occurrence of Fistula.	Patient's Name and Residence.	Age.	Cause.	Characters, Situation, &c., of External Opening.	Size of External Opening.	Situation of Opening into Stomach, and other morbid appearances in that organ.
I.	1560?	Puggebrolt, a Bohemian peasant.	Adult.	Wound from cutlass.	Not recorded.	Admitted finger.	"Below cardiac orifice."
II.	1650?	A beggar at Castres.	Adult.	No mention made of any injury; and probably from simple ulcer of stomach.	Not recorded.	Admitted finger.	?
III.	16—?	A boy.	13	Simple ulcer of stomach? Abscess in liver opening into stomach, and through abdominal parietes.	Near umbilicus. "Fistula umbilici funesta."	"Foramen angustum"	Perforation part of stomach wh was adhere to liver.
IV.	16—?	Female Gardener.	Adult.	Simple ulcer of stomach? "Huic vermes fundum ventriculi perforârunt."	Left hypochondrium. "Circa latus sinistrum." Indurated margins.	"Ulcus apertum circulo, durisque labiis."	At fundus
V.	16—?	?	Adult.	An incised (?) wound.	?	?	?
VI.	17—?	?	Adult.	External wound from a knife.	Middle of Epigastrium.	Admitted finger.	?
VII.	17—?	A female.	Aged.	Cancer of stomach.	Left hypochondrium.	? Apparently small.	Probably fundus? A "scirrhus pylorus," a contracted stomach.

STULÆ, ARRANGED CHRONOLOGICALLY.

Observations on Escape of Food, Prolapsus of Stomach, &c.	Duration of Fistula and Results. General Health of Patient.	Physiological Observations.	Observers.	References.
food and drink aped, immetely on removg linen plug.	Many years. Enjoyed good health	None.	Matthias Cornax.	Journ. de Méd. et de Chir. par Roux et Corvisart, tom. iii, p. 508, 1802.
me flowed out nediately on oving linen g.	Many years. Enjoyed good health	None.	Petrus Borellus.	Petri Borelli, Hist. et Obs. Med. Phys., obs. lxvi, p. 69, 1676. Journ. de Méd. et de Chir. par Roux et Corvisart, tom. iii, p. 508, 1802.
escaped soon r being swaled.	Eighteen months. Increased desire for food. Died with numerous abscesses in liver.	None.	Ludolph. G. Klein.	Ephemerides Med. Phys. Germ., Ed. Norib., tom. x, obs. lxxii, p. 248, 1754. Gérard, "Perf. Spont. de l'Estomac," 1803.
s, and all food cult of diges, escaped by ning.	Twelve years. Went about her work, sold vegetables, &c.	None.	?	Ephemerides Med. Phys. Germ., Ed. Lips., ann. iv et v, obs. xxxviii, p. 36, 1676.
of aliment ays escaped t.	Eleven years.	None.	?	Ephem. Med. Phys. Germ., quoted by Gooch in Pract. Treat. on Wounds, vol. i, p. 398, 1767.
escaped from immediately it was swald.	Two months in fistulous condition —then closed up.	None.	M. Lasséré.	M. Hévin, in Mém. de l'Acad. Roy. de Chir., tom. i, p. 594, 1743.
d ingesta esd by it, if she ed on left	?	None.	Souyer Dulac.	Lieutaud, Hist. Anat. Med., vol. ii, obs. cxlv, p. 327, 1767. Gérard, "Perf. Sp. de l'Estomac," Paris, 1803, p. 71.

No. of Case.	Date of occurrence of Fistula.	Patient's Name and Residence.	Age.	Cause	Characters, Situation, &c., of External Opening.	Size of External Opening.	Situation of Opening in Stomach, and other morbid appearances of that organ.
VIII.	1712 to 1739.	Marguerite Eiguerin, of Norlingen.	19 to 46	Necrosis of ribs with abscess, which at first only opened externally, and healed. Four years after, a second abscess, from which, on opening, food escaped. Was there originally simple ulcer of stomach?	Between eighth and ninth ribs, four inches from xyphoid cartilage, and two from left nipple. Ninth costal cartilage and portion of tenth rib necrosed.	Two inches in diameter. Easily admitted thumb. Cartilaginous margins. Skin excoriated.	Opening at middle of great curvature; between this and pylorus, stomach much contracted.
IX.	1715 May 16.	A widow.	36	Cancer. A scirrhous mass, 5 inches by 2½, involved stomach and arch of colon; intimately uniting these with abdominal parietes and one another. Opening through skin for 11 days before food came from it.	In umbilical region.	Easily admitted finger.	A cancerous ulcer in middle of great curvature, two inches in diameter, in centre of which a perforation the size of a shilling.
X.	1719.	A virgin at Leipsic.	20 to 30	Blow in epigastrium from a carriage shaft—followed by abscess, which opened in six months.	Left of epigastrium.	Size of a large pea or haricot	?

servations on cape of food, 'rolapsus of tomach, &c.	Duration of Fistula and Results. General Health of Patient.	Physiological Observations.	Observers.	References.
of foodwould pe by opening u not pre- ted.	Twenty-seven yrs. "Embonpoint." Could do light work. Intense hunger. Obstinate constipation; no stool at first for seventeen weeks! Urine scanty. Pure blood from stomach at every menstrual period. Ultimately died with numerous abscesses in spleen and liver.	When food swallowed, coats of stomach often seen to contract violently, with an antiperistaltic movement—almost convulsively, until all food ejaculated with force.	Augustus and Christopher Wencher. Haller was present at the *post mortem*.	C. Wencher, "Virginis per 27 annos ventriculum perforatum alentis historia et sectio," Strasbourg, 1743. Licutaud, Hist. Anat. Med., lib. ii, obs. cxlv, p. 327, 1767. Haller, Disp. Chirurg., tom. v, No. 125, p. 18, 1756. Roux, Journ. de Méd. de Roux et Corv., tom. iii, p. 513, 1802. Gérard, Perf. Spont. de l'Estomac, Paris, 1803, p. 70. Cruveilhier, Traité d'Anat. Path., tom. ii, p. 566, 1852.
er part of escaped by quite unal- l.	Three months. Extreme emaciation and exhaustion.	None.	M. Petit.	Petit, Mém. de l'Acad. Roy. des Sc., 1716, p. 312. Haller, Disp. Chirurg., tom. v, No. 125, obs. v, p. 31, 1756. Roux, Journ. de Méd. de Roux et Corv., tom. iii, p. 524, 1802.
and drink ped immc- ly on being lowed.	Ten years. Went about usual occupation, to market, &c. Ultimately *cured* by a few weeks of repose.	None.	M. E. Ettmuller.	Ettmuller, "De vulnere ventriculi," Leipsic, 1730. Haller, Disp. Chirurg., tom. v, No. 163, 1756. Roux, Journ. de Méd. de Roux et Corv., tom. iii, p. 525, 1802. Gérard, Perf. Sp. de l'Estomac, Paris, 1803, p. 69.

No. of Case.	Date of occurrence of Fistula.	Patient's Name and Residence.	Age.	Cause.	Characters, Situation, &c., of External Opening.	Size of External Opening.	Situation of Opening in Stomach, and other morbid appearances of that organ.
XI.	1740.?	A female.	Adult.	Simple ulcer of stomach. First a tumour at epigastrium — this disappeared—skin became drawn in and like a cicatrix. More than a year after, fluid first seen to escape from this.	In epigastrium.	? Apparently small.	?
XII.	1742. July.	A widow.	37	Cancer of pyloric end of stomach.	Near umbilicus.	Admitted finger.	Pylorus adherent to umbilicus, and to left lobe of liver. Here "omnia erant putrida."
XIII.	1768. May.	Mrs. Tovell, of Wenhaston, near Norwich.	60	Simple ulcer of stomach. Twenty years before had a slight injury over stomach—after this liable to pains in left side. In ten years a tumour at epigastrium, with fever, &c.; and in ten years more this opened.	In epigastrium. "No ill appearance about ulcer."	Of some size, as solid food escaped.	Near pylorus. Firm adhesion of stomach and liver round about orifice.
XIV.	1794. October.	M. Maillot, Lieut. of French Infantry at battle of Kayserlautern.	Adult.	Gun-shot wound. Ball extracted—followed by inflammation and sloughing of adherent wall of stomach.	Close to ensiform cartilage, rounded	Half an inch. "15-sous piece."	?

Observations on Escape of Food, Prolapsus of Stomach, &c.	Duration of Fistula and Results. General Health of Patient.	Physiological Observations.	Observers.	References.
ed wine and ulpy food seen o escape by it, ust after being wallowed.	But a short time, and closed spontaneously.	None.	Morgagni.	Morgagni, De Sedibus et Causis Morborum, 1761, lib. iii, epist. 36, Ninth Edit., 1821, vol. iv, p. 410. Gérard, Perf. Spont. de l'Estomac, 1803, p. 69.
verything swal-owed escaped by t.	Threeweeks. Died. Appetite good until death.	None.	Communicated to Haller.	Haller, Disp. Chirurg., tom. v, No. 125, obs. iv, p. 30, 1756.
hen dressings emoved, every-hing swallowed ould escape at rifice.	Three and a half months. Did not lose flesh, and went about usual occupations. No sickness, and one stool every day. Died from effects of cold.	None.	Benjamin Gooch and Mr. Aldrich.	Gooch, Pract. Treat. on Wounds, vol. iii, Appendix, p. 140, 1774. Roux, Journ. de Méd. de Roux et Corv., tom. iii, p. 503, 1802.
hen plug remo-ed after meals, ood immediately scaped by it.	Eight and a half years at least, as he was not dead when case reported. Enjoyed good health.	Interior of stomach seen to be "d'un rouge très vif, et plissé dans tous les sens." Undulations of its surface occasionally observed, increased by contact of air or food. On making an effort to swallow, a lighted candle held before opening was agitated.	M. Percy.	Roux, Journ. de Méd. de Roux et Corv., tom. iii, p. 510, 1802. Gérard, Perf. Spont. de l'Estomac, Paris, 1803, p. 70.

No. of Case.	Date of occurrence of Fistula.	Patient's Name and Residence.	Age.	Cause.	Characters, Situation, &c., of External Opening.	Size of External Opening.	Situation of Opening in Stomach, and other morbid appearances of that organ
XV.	1793.	Magdelaine Goré, of Roussigny, Dept. of La Manche, a patient in "La Charité," Paris.	39 to 48	Simple ulcer of stomach. At age of 20, received an injury on epigastrium from fall on door-step. After this, liable to attacks of severe pain in stomach. Eighteen years after, an abscess, which opened on twenty-first day.	Opening oval, situated at upper and left part of epigastrium, one-third in epigastrium, and two-thirds in thoracic walls. Ninth, tenth, and part of eighth left costal cartilages wanting, and seventh sloped away. Surrounding integuments red and scaly.	1½ inch by 1¼.	Opening in anterior wall, eight inches from fundus, and four from pylorus. Extended from upper to lower margin.
XVI.	June 6, 1822, till present time, 1857.	Alexis St. Martin, a Canadian, a "voyageur" in Hudson's Bay Compy., wounded at Michilli-mackinac, in Michigan.	18 to 53	Gun-shot wound. Charge of powder and duck-shot, at distance of only one yard. Blew off integuments and muscles over space, size of man's hand, carried away anterior half of sixth rib, perforated stomach, and exposed left lung.	Opening situated two inches below left nipple, in a line drawn from this to spine of left ilium. One year after injury, parts were all sound, and firmly cicatrized, except opening into stomach.	2½ inches in circumference.	Opening three inches to left of cardia, near left superior termination of great curvature.

Observations on Escape of Food, Prolapsus of Stomach, &c.	Duration of Fistula and Results. General Health of Patient.	Physiological Observations.	Observers.	References.
ry day for ght years, three four hours er food, was liged, from "ir- sistible desire," remove plug, d evacuate sto- ach. On re- oving plug, omach would otrude several es, forming a d across open- g.	Eight and a half years. Health good. Could walk about. Ate any- thing, and as much as three other women. One stool in four days. Rounded sey- bala. One pint urine in twenty- four hours. Died of marasmus after an attack of diar- rhœa.	Interior of stomach, when empty in morn- ing, seen to be "d'un rouge vermeil, enduit d'un mucus luisant." Longitudinal plicæ. Two sets of undulat- ing movements, one towards pylorus, another towards fis- tula. Much gas escaped with food. Never could sleep, unless stomach was washed out with in- fusion of chamomile. Gastric juice de- scribed and analysed. Fluid collected in morning before meals "neither acid nor alkaline."	Roux and Corvisart; Dupuytren, Bichat, &c. Chemical Experiments by M. Clarion.	Roux and Corvisart, Journ. de Méd., tom. iii, p. 407. Gérard, Perf. Spont. de l'Estomac, 1803, p. 71. Richerand's Physiology, Fifth Ed., 1811, Dr. Copland's Eng. Ed., 1824, p. 112. Cru- veilhier, Traité d'Anat. Path., tom. ii, p. 564, 1852. Preparation and wax models in Musée Dupuytren, at Paris. Appareil Digest., Nos. 60, 61, 62.
first, all food d drink dis- arged by it, on thdrawal of ificial plug; t one year and alf after injury, accurate na- ral plug was med by a pro- sion of the icous mem- ane, and food by escapes on depression of s.	Thirty-five years, and is still alive (1857). Has enjoyed perfect health; has mar- ried, become the father of a family; and earned a livelihood for them by a labo- rious occupation.	Mucous membrane of a pale pink, varying in hue according to full or empty state of stomach. Tempera- ture, 100° F. Rugæ. Vermicular move- ments seen to be increased by food. Irritation of stomach produced faintness, not pain. Physical characters of gastric juice described by Dr. Beaumont; and more recently its chemical nature investigated by Professor Dunglison and Dr. F. S. Smith. Fluid from empty stomach always of neutral reac- tion. Numerous observations on digestibility of different articles of diet, &c. Acidity of gastric juice due to hydrochloric acid (Dunglison), to lactic acid (Smith).	Dr. Beaumont, 1822 to 1833. Professor Dunglison, 1833. Dr. F. S. Smith, of Pennsylvania, 1856.	Beaumont, Experiments and Observations on Gas- tric Juice, Plattsburgh, U. S., 1833. Dr. Combe's Edin. Ed. of above, 1838. References in most modern works on Physiology and Practical Medicine. Dr. F. S. Smith, Philadelphia Medical Examiner, July and Sep., 1856, and Brit. and For. Med.-Chir. Rev., Jan., 1857, p. 241. Dr. Bunting, Lancet, July 19th, 1856. Dunglison's 'Human Physiology,' Seventh Ed., vol. i, pp. 585-6.

No. of Case.	Date of occurrence of Fistula.	Patient's Name and Residence.	Age.	Cause.	Characters, Situation, &c., of External Opening.	Size of External Opening.	Situation of Opening in Stomach, and other morbid appearances of that organ.
XVII.	July 1, 1828.	M. A. W., a widow, Worcester Infirmary.	39	Simple ulcer, producing abscess, adhesions, and external opening.	Between seventh and eighth ribs, below right mamma. Lower margin of seventh rib, and upper of eighth, carious.	"A slit" 1 inch in length.	Immediately *beyond* pylorus, at very commencement of duodenum, two and a half inches from external opening.
XVIII.	June, 1832, and Jany., 1835.	Madame G.	77 and 80	Simple ulcer of stomach. Symptoms for thirty years. At age of 77, an opening over stomach, from which "clear water" escaped for three days, and which then closed. At age of 80, this re-opened, discharging water and food.	In a transverse furrow of the skin in left hypochondrium, two inches below margin of ribs. Margins of opening red. Surrounding integuments drawn in like a funnel.	"Size of a pea." "4 or 5 lines in diameter."	In middle of anterior surface a rounded opening, one and a half inch in diameter, forming large end of a funnel, of which small at external opening. Thickening of pylorus.
XIX.	Sept. 3, 1832.	Mary O'Neill, Meath Hospital, Dublin.	50	Cancer of pyloric end of stomach.	To left of umbilicus.	Size of a large pea. A gum bougee passed readily.	?
XX.	1833.	A Widow, U. States.	39	Simple ulcer of stomach.	Opening at side of umbilicus. Surrounding skin red, excoriated, and tender.	Admitted a musket bullet.	Opening supposed to be near pylorus (from probing).

ervations on cape of Food, Prolapsus of tomach, &c.	Duration of Fistula and Results. General Health of Patient.	Physiological Observations.	Observers.	References.
e and milk rdled), &c., ıped imme- ely on being llowed.	Twenty-six days. Died. Tubercles in lungs. Inflammation of diaphragm and surface of liver.	None.	Dr. Streeton.	Streeton, Lond. Med. Gazette, 1829, vol. iii, p. 43.
wine, and micelli soup, ,seen to escape n opening ıng with air- ıbles) just r being swal- ed.	First time for three days. Second for four. Died of old age, &c. During last four days of life, tongue red and dry—burning thirst—no stools nor urine.	None.	M. Bineaux de Saumur.	Bineaux, Archiv. Gén. de Méd., II. Ser., tom. viii, p. 214, 1835. Cruveilhier, Traité d'Anat. Path., tom. ii, p. 566, 1852.
l, &c., escaped nediately after ıg swallowed. two days opening was ed.	Three weeks. Died exhausted.	None.	Dr. Stokes and Mr. Hamilton.	Hamilton, Lancet, 1832, vol. i, p. 612; Archiv. Gén. de Méd., 1st Ser., tom. xxviii, p. 264, 1832.
er, &c., escaped n opening nty seconds r being swal- ed.	Six and a half months. Had great constipation. No motion for ten days. *Cured* by mechanical appliances to protect abdomen from irritating fluids, compression together of lips of wound, &c.	Does not appear that stomach was visible. A catheter introduced thirteen inches from opening excited vomiting.	Dr. J. H. Cooke.	Cooke, Western Journ. of Med. and Phys. Sc., Jan., 1834. American Journ. of Med. Sc., vol. xiv, p. 271, 1834. Dub. Journ. of Med., vol. vi, No. 16, p. 148. Lond. Med. Gaz., vol. xiv, p. 541. 1834. Archiv. Gén. de Méd., II. Ser., tom. vi, p. 430. Schmidt's Jahrbücher, 1836, vol. ix, p. 61. Chelius's Surgery, South's Ed., vol. i, p. 477.

No. of Case.	Date of occurrence of Fistula.	Patient's Name and Residence.	Age.	Cause.	Characters, Situation, &c., of External Opening.	Size of External Opening.	Situation of Opening in Stomach, and other morbid appearances of that organ.
XXI.	Oct. 22, 1844, to Aug. 11, 1851.	Isabella Davidson, Kelso, Scotland, and Edinburgh Royal Infirmary.	30 to 37	Simple ulcer of stomach (?), inducing an abscess, which first communicated with stomach; then extension of inflammation and perforation of abdominal parietes.	Opening close to cartilage of eighth left rib, 2½ inches from median line, and 3½ from umbilicus. Oval. Margin rounded, depressed, hard, and red; with specks of ulceration. Surrounding integuments red, indurated, and excoriated.	Admitted thumb. Shortly before death, as large as a crown piece.	In anterior wall of stomach, about four inches from cardia.
XXII.	1850.	A married female, at Dorpat.	35	Simple ulcer of stomach.	Opening below left nipple, between ninth and tenth ribs, 2½ inches in an oblique line from the xyphoid cartilage. Margin red, and indurated. Surrounding skin erythematous, from trickling over it of gastric juice.	Half an inch in diameter.	?
XXIII.	Sept. 7, to Oct 8, 1851.	Mrs. R., Braemar, Scotland.	50	Cancer of stomach	Left part of epigastrium.	At first size of a shilling; latterly increased to that of a half-crown piece.	No *post mortem* allowed; but, on introducing finger during life, distinct carcinomatous hardness felt around opening.

Observations on Escape of Food, Prolapsus of Stomach, &c.	Duration of Fistula and Results. General Health of Patient.	Physiological Observations.	Observers.	References.
l food escaped ecly by it, unss prevented by echanical appliances. At first, ic opening was osed by a valve mucous membrane.	Nearly seven years; but during this time opening was twice closed, viz., from Jan., 1845, to Jan., 1846; and from March, 1846, to June, 1847. Was in bed for last three or four years of life. Tongue clean. Appetite good. No thirst. During digestion, pain at orifice. Urine scanty. Bowels confined. Menstruation regular.	A committee was appointed to make observations; but in consequence of patient's state of health, it did nothing. Mucous membrane of stomach was visible, but is not described. Milk swallowed could be seen flowing over it. Contents always highly acid, during digestion. Introduction of a catheter caused faintness, but not pain.	Dr. W. Robertson, of Edinburgh, and Dr. T. Hamilton, of Kelso, N. B.	Robertson, Edin. Monthly Journ. of Med. Sc., Jan., 1851, p. 1. Archiv. Gén. de Méd., IV Ser., tom. xxv, p. 339. Schmidt's Jahrbücher. vol. lxxxii, p. 35. Private letter from Dr. Hamilton, Nov., 1857. A plate showing the external opening accompanies Dr Robertson's paper.
ntents of stoach freely esped by it.	Three years; and patient still alive in 1853. Is otherwise healthy and strong; suckling an equally healthy infant. Has a ravenous appetite.	Numerous observations made as to the quantity, physical characters, and chemical composition of the gastric juice; also as to its digestive powers over different nutritive principles. Acidity of gastric juice due to butyric, and probably lactic acid; it contained no free hydrochloric acid. The secretion from the empty stomach was always neutral.	Professor Schmidt, Otto v. Grünewaldt, and Ernst v. Schröder.	O. v. Grünewaldt, "Succus gastrici humani indoles physica et chemica, et vis digestiva," Inaug. Dissert. Dorpat, 1853. Schmidt's Jahrbücher. vol. lxxxiv, p. 1, 1854.
rything taken mouth passed t at once by ening, unless evented by tta percha plug.	Thirty-one days. Suffered great pain. Bowels confined. Died.	Introduction of laxatives through opening into stomach induced great pain and tendency to vomit.	Dr. James Cameron, of Braemar, N. B.	Private communication from Dr. Cameron through Sir. James Clark.

No. of Case.	Date of occurrence of Fistula.	Patient's Name and Residence.	Age.	Cause.	Characters, Situation, &c., of External Opening.	Size of External Opening.	Situation of Opening in Stomach, and other morbid appearances of that organ.
XXIV.	Oct., 1854.	A female. France.	52	Cancer of stomach	Near umbilicus. Tumour, for many months before ulcerating, had been in epigastrium, but then descended to umbilicus. Margin of opening gangrenous.	Enlarged rapidly by gangrene of integuments.	Cancer at pylorus, in all probability.
XXV.	March 2, 1854, to present time, June, 1858.	Catherine Ross, Aberdeen, Scotland.	32 to 36	Ulceration, produced by pressure from without of a copper penny piece, applied voluntarily by patient.	Opening in epigastric and upper part of umbilical region. Transversely oval. Edges of opening ¾ inch thick, red, glazed, not ulcerated, showing a gradual transition from skin to mucous membrane. Integuments, for some inches around, red, smooth, glistening and tender	Transverse diameter, 4 inches; vertical, 3 inches. Three fingers can be passed into stomach with ease; and one into pylorus or cardia.	Opening about middle of anterior surface.

Observations on Escape of Food, Prolapsus of Stomach, &c.	Duration of Fistula and Results. General Health of Patient.	Physiological Observations.	Observers.	References.
rom date of opening everything swallowed escaped by it.	Five weeks. Died.	None.	Dr. Balluff.	Dr. Balluff, Gaz. Méd. de Paris, 1855, p. 281. Schmidt's Jahrbücher, vol. lxxxiii, p. 49, 1854.
When guttapercha plug removed, everything she swallows is immediately ejected from opening; and even when that is *in situ* liquids ooze out. On sitting up, coughing, or making an effort to vomit, whole stomach becomes everted.	More than four years, and still alive and well. Tongue clean, parched at night. Great thirst. Appetite at times so keen, as to amount to pain. One stool in twelve days. Amenorrhœa.	Mucous membrane of stomach of a bright vermilion colour—will bleed at isolated points when irritated. Handling stomach causes no pain; indeed, she can take it out and put it in again with ease; but such manipulations generally produce a feeling of sinking, and great prostration. When stomach empty, blue litmus paper applied to mucous membrane is not turned red. Waves of contraction seen passing along rugæ, increased by contact of food. Observation on mechanism of vomiting.	Dr. W. Keith, Aberdeen, and Dr. Murchison.	Account of case read before Royal Medical and Chirurgical Society of London, November 24th, 1857.

C. *The Causes of Gastro-cutaneous Fistulæ.*

Gastro-cutaneous fistulæ may be divided into those which are the consequences of mechanical injuries, and those which result from disease.

I. *Mechanical Injuries.*—Seven of the cases enumerated appear to have resulted from mechanical injury of some sort, and no doubt a careful search of the records of military surgery might increase this number. Wounds of the abdominal parietes involving the stomach are in most cases mortal. There are several instances, however, on record, in which they have healed up, and a speedy recovery has resulted.[1] In other cases, again, the margin of the wound in the stomach has contracted adhesions to that in the abdominal parietes, so as to constitute a permanent fistula.

Wounds or mechanical injuries, which may give rise to such fistulæ, appear to be of four sorts :

1. Incised wounds of the abdomen penetrating the stomach. Three of the seven cases were of this nature (1, 5, 6).

2. Gun-shot wounds (two cases, 14 and 16) ; the discharge either directly penetrating the stomach, as in the celebrated case of Alexis St. Martin, or inducing inflammation and subsequent sloughing of a portion of the wall of the stomach bordering on the original wound, as in the case of Maillot, a French lieutenant of infantry.

3. A blow over the stomach, without any laceration of the surface, may give rise to an abscess, which may open both into the stomach and also externally. This appears to have been the cause in Case 10. This patient received a blow in the epigastrium from a carriage shaft ; an abscess followed, which in six months opened externally, and food swallowed was observed to escape from the opening. Case

[1] See, for instance, several remarkable instances mentioned by M. Hévin in the 'Mém. de l'Acad. Roy. de Chirurgie,' tom. i, part ii, p. 349, 1743 ; Gooch's 'Treatise on Wounds,' vol. i, p. 397 ; and Chelius's 'Surgery,' South's ed., vol i, p. 475.

15, also, was referred to an injury of this nature; but, inasmuch as eighteen years elapsed between its infliction and the appearance of the abscess, this explanation is doubtful.

4. Ulcerations from external pressure. The case of Catherine Ross is the only one recorded resulting from such a cause. The means adopted were not novel. Soldiers and sailors have been known to tie copper coins over open ulcers in their legs, to prevent the healing of these, and so elude their duty, or obtain a discharge from the service.[1] But that a female should have recourse to such a proceeding, at such a part of the body, and when fully warned of its danger, is certainly a unique mode of courting notoriety. Yet if one really desired to obtain such a fistula, a safer process could hardly be adopted, than that followed by Catherine Ross. Its slowness gives ample time for the stomach to contract adhesions to the abdominal parietes, and thus the escape of its contents into the peritoneal cavity is prevented.

5. It seems possible that an injury of the stomach *from within,* might end in the formation of an external fistula. There are many instances on record of persons having swallowed large foreign bodies, such as knives and other cutting instruments, and surviving; the foreign bodies, after the lapse of a considerable period, escaping by abscesses through the abdominal parietes.[2] I have not been able, however, to find any case in which food is stated to have escaped from the external opening; so that probably the wound in the gut in most cases closes before the abscess opens externally.

II. *Disease.*—The morbid conditions, of which we can speak with certainty as capable of giving rise to external fistulæ of the stomach, are only two, viz., cancer and simple perforating ulcer of the stomach. In both of these affections the escape of the contents of the stomach into

[1] Gavin, on 'Feigned and Fictitious Diseases,' p. 337.

[2] See M. Hévin's 'Memoir,' loc. cit.; also the notice 'De Prusso Cultrivore' in the 'Trans. Roy. Soc. Lond.,' 1696, vol. xix, p. 179.

the peritoneal cavity, on the occurrence of perforation, may be prevented by the previous contraction of adhesions to the abdominal walls, which last may also be perforated by a continuation of the original disease.

Opinions seem divided as to the relative frequency of these causes. Thus, Cruveilhier brings forward several cases depending on simple ulcer, but says he is not acquainted with an instance resulting from cancer, although he observes, it is not rare to meet with a cancerous pylorus adherent to the adominal wall;[1] and Dr. Brinton states, as the result of his researches, that he has found about six cases resulting from simple ulcer, but only one from cancer.[2] Rokitansky, on the other hand, says a cancerous ulcer may force its way through the abdominal parietes, but makes no mention of such an occurrence when speaking of the simple perforating ulcer.[3] Of the cases collected by myself:[4]

Six appear to have resulted from cancer (7? 9, 12, 19, 23, and 24); and 12 from simple perforating ulcer (2? 3, 4, 8, 11, 13, 15, 17, 18, 20? 21, 22).

Although, with regard to one or two of the older cases, the distinction between cancer and simple ulcer may be a matter of question, yet from a careful reference to the history, symptoms, and *post-mortem* appearances of these cases, I believe the statements made in the preceding table to be correct. Gastro-cutaneous fistula would thus appear to be twice as frequently the result of simple ulcer as of cancer. Now this is exactly the reverse of what has been found to hold good in the case of gastro-colic fistula.[5] This is probably owing partly to the difference in the relative situation of the two diseases. Simple ulcer, as shown by Dr. Brinton, is very rare in that part of the stomach

[1] 'Traité d'Anat. Path.,' ii, 566.

[2] 'Brit. and For. Med. Chir. Rev.,' January, 1856, p. 175; and April, 1857, p. 479.

[3] 'Path. Anat.' Syd. Soc. Ed., vol. ii, pp. 33—43.

[4] The figures refer to the number of the cases in the table, and will be repeated in the course of the paper, in order to facilitate comparison.

[5] See memoir by author on 'Gastro-Colic Fistula,' 'Edin. Med. Journ.,' August, 1857, p. 122.

nearest the colon, whereas of simple ulcers ending in perforation a very large proportion are found upon the anterior surface.[1] Again, as the length of time necessary to perforate the abdominal muscles and integuments must be considerable, in many cases of adherent cancerous stomach the patient no doubt sinks under the disease before the perforation is complete.

Of the six cases of cancer, in three the disease was situated at the pylorus (12, 19, and 24); in two (7 and 23) it was probably near the great curvature, but in one of these (7) there was also "scirrhus of the pylorus." In the sixth case (9) there was a large cancerous mass between the stomach and the arch of the colon, which had almost established a communication between these two portions of the digestive canal, as well as between the stomach and external surface.

In some of the cases of simple ulcer the fistula appears to have resulted from a gradual extension of the ulcerative process through the adherent abdominal parietes; but in many, perhaps most, the perforation of the stomach would seem to have excited a limited inflammation of the peritoneum, ending in chronic abscess, which has ultimately discharged its contents through the abdominal wall. Several cases have been recorded illustrative of the various stages of this mode of formation. Amongst these there is one remarkable instance which was brought before the notice of the Royal Medical and Chirurgical Society, by Mr. Lloyd, on November 14th, 1843, of an abscess pointing in the abdomen, which it had been resolved to open. The patient, however, died suddenly before this was done, and the abscess was found to communicate with an ulcer of the stomach.[2]

In some of the cases it may be questioned whether this abscess has not originated external to, and quite independently of, the stomach, ultimately bursting into this viscus, and also opening externally. Thus, in Case 3 the

[1] 'Brit. and For. Med. Chir. Rev.,' January, 1856, pp. 162, 172, and 173.

[2] 'Lancet,' 1843-4, vol. i, p. 273. See also Cruveilhier, op. cit., ii, 566.

abscess may possibly have originated in the liver; and in Case 8, in the abdominal parietes, from necrosis of the ribs. Hepatic and other abdominal abscesses, we know, may burst into the stomach,[1] and there seems no reason why they should not at the same time open externally. Should this explanation apply to any of the above cases, of course the number referred to simple ulcer of the stomach would be somewhat diminished.

Case 4 was ascribed to the erosion of a worm, but was probably a case of simple ulcer, in which a round worm may have come away through the opening.

As regards the situation of the opening in the stomach in the cases of simple ulcer, in

2 cases this was doubtful (2, 11);

3 cases it was near the fundus (4? 21, 22);

3 cases it was near middle of anterior surface (8, 15, 18);

4 cases it was at or near the pylorus (3, 12, 17, 20?).

In one of these last cases the opening was situated rather on the duodenal side of the pylorus; and perhaps it should have been excluded from this list. The ingesta, however, were observed to escape as readily from the opening in this case, as if it had been in the stomach itself.

It is a curious fact, that all the patients with cancerous fistula, and all but two in which it resulted from simple ulcer, were females; and in one of the two exceptional cases the sex is not recorded.

D. *Situation, Size, and other characters of the External Opening.*

1. *Situation.* The situation of the external opening in these cases resulting from disease of course depends, in a great measure, on the region of the stomach from which the fistula originates. Thus, if this be the neighbourhood of the pylorus, the external opening is generally near the umbilicus; or, if the disease commences in the anterior surface or near the fundus of the stomach, the external opening will occupy the epigastric or left hypochondriac region.

[1] Dr. Graves's 'Lectures on Clinical Medicine,' vol. ii, p. 232.

In four cases (8, 15, 16, and 22) the opening was situated between some of the left ribs, portions of which, or of their cartilages, had been removed. In Case 16 (St. Martin) this was the result of a gun-shot wound. In 15 and 22, and perhaps also in 8, the ribs appear to have been destroyed in the progress of a simple ulcer of the stomach. In Case 17, which originated in a perforating ulcer on the duodenal margin of the pylorus, the external opening was between the seventh and eight *right* ribs, below the right mamma. In connexion with this, it is important to allude to a case mentioned by Cruveilhier, in which a simple ulcer, commencing in the stomach, was found to have eroded the posterior surface of the ensiform cartilage.[1]

2. The *margins* of the opening are generally described as rounded, hard, or of cartilaginous consistence, in those cases resulting from either wound or simple ulceration. In two cases (11 and 21) the margins are noted as having been depressed or drawn in; and in a third (18) this retraction of the margins was so great, that the opening resembled a funnel. All these three were cases of simple ulcer of the stomach. In cases resulting from cancer, the margins of the opening may be ragged, or even gangrenous. In Catherine Ross they are red, glazed, and firmly cicatrized, and there appears to be a gradual transition between the skin and mucous membrane.

3. The *integuments surrounding* the opening for some inches are usually red, tender, and more or less excoriated, owing to the irritation from the constant escape of the fluid contents of the stomach.

4. The *size* of the external opening varies greatly. Thus—

In 7 cases it was doubtful (3, 4, 5, 7, 11, 17, 24);

In 6 cases it was less than 1 inch (10, 14, 18, 19, 20, 22);

In 7 cases it was about 1 inch in diameter, or easily admitted finger (1, 2, 6, 9, 12, 13, 16);

In 1 case it was 1½ by 1¼ inch (15.)

[1] Op. cit., ii, 566.

In 1 case it was 2 inches in diameter (8);

In 2 cases it was at first about 1 inch in diameter, but, shortly before death, increased to the size of a half-crown, or a whole crown piece (21, 23);

In 1 case it was 4 inches by 3 (25).

It will thus be seen that in none of the cases hitherto recorded did the opening at all equal in size that which exists in Catherine Ross (25).

E. *Escape of Food swallowed by Artificial Opening.*

In all of the cases this phenomenon was observed. In six cases (7, 11, 17, 18, 19 and 20) fluids only are stated to have escaped, and in these the opening was either very small, or no mention is made of its size. In all the other cases, whatever the patient swallowed immediately escaped from the opening. This escape of food has usually been prevented by some artificial contrivance, such as a plug of linen, gutta percha, &c.; but it has always been found difficult to prevent the fluid ingesta from oozing out by the sides of the plug. In the case of Alexis St. Martin, the necessity for such an artificial plug became, after a time, superseded by a natural one, consisting of a slight protrusion of the coats of the stomach, so that food only escapes on the depression of this. It is probably to this provision of nature for preventing the escape of food, that this individual's good health and long life are in no small degree to be attributed. A tendency to the formation of a similar natural plug was also observed in Cases 15 and 21; but in the case of Catherine Ross the opening is so large that the whole stomach becomes everted through it.

It is to be remembered, in reference to the diagnosis of such cases, that a fistulous opening in the abdominal walls, from which food escapes immediately on being swallowed, does not necessarily communicate directly with the stomach. We have already seen that in Case 17 the opening was rather on the duodenal side of the pylorus. Again, in the museum of Charing Cross Hospital there is a preparation

(G. 21) of a cancerous stricture of the arch of the colon, in which the colon above the stricture communicated with the duodenum, and also, through the abdominal parietes, with the external surface. In this case, any fluid taken into the stomach, flowing by the duodenum into the colon, made its appearance, in a few minutes, at the umbilicus.

F. *Duration of the Fistula, and possibility of Cure.*

The length of time during which an individual may live with a fistulous opening into the stomach, varies very greatly with the cause on which the fistula depends.

1. As might be expected, all the cases dependent on cancer have proved very speedily fatal, three months being the longest period during which a person has lived with a cancerous fistula. Of the six cases of cancer, the duration of life, after the formation of the fistula, was as follows:

In 1 case it was doubtful (7).

In 2 cases it was 3 weeks (12, 19).

In 1 case it was 4 weeks and 3 days (23).

In 1 case it was 5 weeks (24).

In 1 case it was 3 months (9).

2. Wounds of the stomach, as already stated, are generally mortal; or, in a few instances, become speedily cured. The fistula, however, to which they now and then give rise, may continue for years. Thus—

In Case 6 it lasted 2 months, and was cured.

In Case 1 it lasted many years.

In Case 10 it lasted 10 years, and was cured.

In Case 5 it lasted 11 years.

In Case 14 it lasted 8½ years at least; as the patient was not dead when the case was reported.

In Case 25 it lasted 4 years, and still alive.

In Case 16, it lasted 35 years, and still alive.

3. Of the cases resulting from simple ulcer—

In Case 17 the patient lived 26 days, but died with tubercles in lungs.

In Case 11 opening lasted a "short time," and closed up spontaneously.

In Case 18 opening closed after 3 days; 3 years after, it opened again, and on the 4th day patient died.

In Case 13 patient lived $3\frac{1}{2}$ months, and died from effects of cold.

In Case 20 opening lasted $6\frac{1}{2}$ months, and was cured.

In Case 3 patient lived $1\frac{1}{2}$ year.

In Case 21 opening lasted 7 years, but was twice closed during this period for upwards of a year.

In Case 15 opening lasted $8\frac{1}{2}$ years.

In Case 4 opening lasted 12 years.

In Case 8 opening lasted 27 years.

In Case 2 opening lasted "many years."

In Case 22 opening lasted 3 years, and still alive in 1853.

Thus, if we except the first four cases, in which either the opening closed up spontaneously or death resulted from independent causes, the most of the others lived for many years. It is to be observed that in three cases (11, 18, and 21) the opening closed up spontaneously. In Case 11 the cure appears to have been permanent; in Case 18 the fistula reopened after an interval of three years; and in Case 21 the opening was twice closed for upwards of a year, and as often reopened.

This leads us to consider the question of the possibility of curing such cases. In six of the cases the opening became closed (2, 10, 11, 18, 20, 21). Two of these cases (2, 10) resulted from wound; the other four from simple ulcer. In four of the six cases the opening appears to have closed spontaneously (2, 11, 18, 21); and in two of these (18 and 21) the fistula reopened. In two cases only does the obliteration of the fistula appear to have been the result of treatment. In Case 10 a fistula, resulting from an injury, of ten years' duration, was closed by simply making the patient, who had been in the habit of always going about, keep quiet in her bed for a few weeks; and in Case 20 a cure was effected by ingenious local appliances, of such a nature as to prevent the contact of the irritating contents of the stomach with the surrounding skin, and at the same time approximating the edges of the opening by means of

the gradually increased compression of a circular bandage, while at the same time the patient was nourished chiefly *per rectum*.[1] In none of the cases does any cutting or paring of the edges of the wound appear to have been attempted. Dr. Keith seems to consider such a procedure practicable in the case of Catherine Ross, provided that she herself would throw no obstacle in the way. It is much to be feared, however, that in any such operation the contact of the gastric juice and the distention of the stomach by food would very much interfere with union by the first intention, while, at the same time, there would be a risk of exciting dangerous inflammation of the stomach.

G. *General health of persons with Gastro-cutaneous Fistulæ.*

It is astonishing to observe how little influence the existence of a gastro-cutaneous fistula has upon the general health. In most of the cases resulting from wound or simple ulcer the patients are stated to have enjoyed excellent health. This was particularly remarkable in Wencher's case of a woman, who lived for twenty-seven years with such a fistula, following her ordinary avocations; and is still more so in the case of Alexis St. Martin, who, during the last thirty-five years that the fistula has existed, has married and become the father of several children, earning a livelihood for his family by a laborious occupation. In Catherine Ross the state of general debility is more to be attributed to a general derangement of the entire nervous system than to the effects of the fistula.

The principal abnormal symptoms which have been observed as dependent upon the fistula are, great thirst, increased appetite, obstinate constipation, deficient secretion of urine, and amenorrhœa. The most of these symptoms are directly traceable to the constant escape of the ingesta

[1] For a fuller account of the treatment in this case, see South's ed. of Chelius's 'Surgery,' vol. i, p. 477.

from the abnormal opening. This continual drain creates a craving for an additional supply, while at the same time it cuts off the material necessary for the production of fæces and urine. In Case 15 the patient is said to have eaten as much as any three other women, and in Catherine Ross the feeling of hunger sometimes amounts to actual pain. There may be but one stool every three, four, or even twelve days; and this has, in several instances, been observed to consist of hard rounded scybala, like the droppings of a sheep.

Vomiting appears to have been a very unusual symptom in all of the cases, although it may have been very urgent before the formation of the fistula. In Case 15, however, there was an irresistible desire, three or four hours after each meal, to remove the plug, and evacuate the contents of the stomach. This same person also could never sleep unless she had previously washed out the stomach with an infusion of chamomile.

In Case 8 a vicarious discharge of pure blood from the mucous membrane of the stomach occurred at every menstrual period.

H. *Physiological observations on the Stomach, &c.*

Cases such as those we have been considering afford the opportunity of observing during life in the human subject—

1. The physical characters and properties of the coats of the stomach, such as its peculiar movements, the colour, &c., of the mucous membrane, &c.; and

2. The physical and chemical characters of the gastric juice, and its digestive power over different nutritive principles and articles of diet.

I. Observations of the former class have been made in six of the cases (8, 14, 15, 16, 21, and 25).

In Case 8, when food was swallowed the stomach could be seen occasionally to contract violently so as to expel the food with force. No mention, however, is made of the condition of the diaphragm and abdominal muscles.

In Case 14 the surface of the stomach is described as "d'un rouge très vif, et plissé dans tous les sens." Undulating movements could also be seen passing along the surface, which were increased by the contact of food. When the patient made the effort of swallowing, a lighted candle held to the fistula became agitated.

In Case 15 the interior of the stomach in the morning, before any food was taken, was said to be "d'un rouge vermeil, enduit d'un mucus luisant." It was disposed in longitudinal plicæ; and two sets of undulatory movements were observed, one towards the pylorus and the other towards the fistula.

In Case 16 Dr. Beaumont describes the mucous membrane as of a pale pink colour, increased in hue when food entered the stomach. Vermicular movements were observed, which were augmented into a churning motion by the contact of food. Mechanical irritation of the stomach produced faintness, but not pain.

This last observation was also noted in Case 21.

In Catherine Ross (25) the mucous membrane is of a vermilion red colour, disposed in rugæ, along which undulating movements can be observed. The freest manipulation of the stomach only produces faintness, not pain.

The observation made upon Catherine Ross, as regards the mechanism of vomiting, is of peculiar interest. During the last century there was a great controversy as to the precise mode in which this act is effected, and even at the present day we find the greatest variety of opinions expressed by different physiologists concerning it. These various opinions may be reduced to the four following:

1. Down to the end of the seventeenth century the almost universal belief appears to have been, that vomiting was the result of the convulsive contractions of the stomach itself; and, more recently, Haller, Rudolphi, and others, have considered the contraction of the surrounding muscles as unnecessary, or, at most, only auxiliary.

2. Another class of physiologists, commencing with Bayle

of Toulouse[1] (A.D. 1681), and including John Hunter,[2] have maintained that the stomach is nearly or entirely passive during vomiting, and that this action is excited by extraneous pressure of the diaphragm and other abdominal muscles. The greatest supporter of this theory has been Majendie, who drew his conclusions from observing the non-occurrence of vomiting after dividing the phrenic nerves, so as to paralyse the diaphragm, and removing the abdominal parietes; and the fact that it did take place when a pig's bladder was substituted for the stomach, the muscles remaining intact.

3. A third class, while they have admitted that the act has a double origin, depending on the contraction of the stomach, assisted by that of the abdominal muscles, have yet maintained that it is only the muscles of expiration which by their contraction compress the stomach; and that, after the first inspiration, the diaphragm becomes relaxed. This opinion, that vomiting is mainly an *expiratory* act, was propounded by Lieutaud, so long ago as 1752;[3] and in modern times has been strongly advocated by the late Dr. Marshall Hall.[4] It is also the view which is taught by Dr. Carpenter in his 'Principles of Physiology.' "It is not true," Dr. Carpenter observes, "that the diaphragm actively co-operates in the effect of vomiting;"[5] although he admits that this muscle, by its being passively fixed, may supply a firm surface, against which the stomach is pressed.

4. Lastly, there are others who believe that, while the stomach itself contracts, the vomitive act is in the main effected by both the muscles of expiration and inspiration; in other words, that the diaphragm remains contracted after the expiratory muscles come into play, and that, by the simultaneously opposing forces, the stomach is so compressed as to be evacuated of its contents. Dr. David Anderson, in an inaugural thesis presented to the medical faculty of the

[1] 'Dissert. sur quelques points de Physique et de Médecine,' Toulouse, 1681.

[2] 'Hunter's Works,' edited by Palmer, vol. iv, p. 92.

[3] 'Mém. de l'Acad. Roy. des Sciences,' tom. lxviii, p. 230.

[4] 'Quarterly Journal of Science,' June, 1828, vol. xxv, p. 388.

[5] 'Principles of Human Physiology,' fifth ed., p. 69.

University of Edinburgh, in 1842, proved by experiment that the diaphragm is rigidly contracted during vomiting. This he ascertained by laying open, and introducing his hand into, the abdomen of dogs which were vomiting from the effects of tartar emetic.[1] The correctness of this view is also supported by the powerful advocacy of Messrs. Todd and Bowman,[2] and is corroborated by what has been observed in the case of Catherine Ross. This case shows that although the coats of the stomach itself do undoubtedly contract, the principal part of the act is played by both the diaphragm and abdominal muscles. The upper wall of the stomach can be distinctly seen to be pressed down by the diaphragm. The contraction of the stomach appears to be confined to the pyloric region, and to have for its object chiefly the closure of the pylorus, so that when the stomach becomes compressed between the diaphragm and abdominal parietes, the only exit for its contents, in the natural condition of the parts, must be through the œsophagus. From all the observations which have been made on the matter, the following would appear to be the mechanism of an act of vomiting:

1. A long inspiration followed by partial closure of the glottis.

2. Contraction of the pyloric end of the stomach, with relaxation of the cardia and œsophagus.

3. Persistent contraction of the diaphragm, with rigid contraction of the recti and oblique muscles.

In connection with this subject, I may be allowed to correct an erroneous statement of facts, which is to be found in several English works on physiology. Dr. Carpenter, in quoting a case, observed by a French surgeon, M. Lépine, to prove that the walls of the stomach contract during the act of vomiting, observes: "In this case, the abdominal parietes having been accidentally laid open in the human

[1] 'Lond. and Edin. Monthly Journal of Medical Science,' 1844 p. 1.

[2] 'Physiological Anatomy,' vol. ii, p. 213.

subject, and the stomach having wholly protruded itself, it was seen to contract itself repeatedly and forcibly, during the space of half an hour, until by its own efforts it had expelled all its contents except gases."[1] A similar account of the case has been given by Mr. Paget;[2] and by Messrs. Todd and Bowman;[3] the latter, however, quote from Mr. Paget. How completely different were the phenomena really presented by this case, will be at once apparent on reading the following extract from the original account.

"Pendant tout le temps que l'estomac fut hors de l'abdomen, M. Lépine ne l'a ni vu, ni senti se contracter, quoique, dans le but de provoquer ces contractions, il ait appliqué sur cet organe ses mains, préablement trempées dans l'eau froide. A peine la reduction était elle opérée, qu'aux nausées, et aux efforts *inutiles pour vomir* succédèrent de veritables vomissements, qui amenèrent au dehors les aliments, que le malade avait pris une demi-heure avant la blessure."[4]

II. There are only three cases which have hitherto been taken advantage of for making observations on the chemical and physical properties and the digestive powers of the gastric juice. (15, 16, and 22.)

1. In the first of these (15), that of Magdelaine Goré, several chemical analyses of the gastric juice, and of the food undergoing digestion, were made by M. Clarion, more than half a century ago. M. Clarion found the gastric juice to contain 9 parts in 1000 of muriates, and 16 parts of an animal principle, precipitated by both alcohol and tannin. He also ascertained that, although the contents of the stomach during digestion were always acid, the fluid collected in the morning before breakfast was perfectly neutral, and had a strong analogy to saliva.

[1] Op. cit., p. 69.

[2] Report on Physiology, 'Brit. and For. Med.-Chir. Rev.,' Jan., 1845, p. 273.

[3] Op. cit., vol. ii, p. 213, note.

[4] 'Bulletins de l'Acad. Roy. de Méd.,' 1844, vol. ix, p. 147.

2. Every one is familiar with the valuable observations made by Dr. Beaumont, in the case of Alexis St. Martin (16), as regards the relative digestibility by the gastric juice of different articles of diet, &c. It would be quite apart from the object of this paper to enter into these here, I would merely call attention to some chemical analyses of the gastric juice obtained from St. Martin, which have been made since Beaumont's observations, and which are less generally known. These analyses have been performed in 1833, by Professor Dunglison, of Philadelphia;[1] and within the last two years, by Dr. F. S. Smith, of the Pennsylvania College.[2] The results arrived at by these two experimenters are, however, somewhat conflicting. Thus Professor Dunglison obtained *hydrochloric acid* with great readiness; and concluded that this acid was the principal, if not the sole, source of the gastic juice: whereas Dr. Smith states, as the result of his experiments, that if hydrochloric acid exists at all, it is in very small quantity, and "that the main agent in producing the acid reaction, is *lactic acid.*" Dr. Smith found the fluid from the empty stomach always neutral.

3. Within the last few years a valuable series of observations, as regards the physical and chemical properties of the gastric juice, have been made on Case 22, and recorded in a thesis by Otto v. Grünewaldt. Professor Schmidt obtained the following results from his analyses: first, that the human gastric juice contains about 36 parts in 1000 of pepsin; secondly, that it contains butyric, and probably also lactic acid; and thirdly, that it contains no free hydrochloric acid, although, according to the experiments of the same chemist, this acid exists in considerable quantity in the gastric juice of some of the lower animals. Lastly, the fluid obtained from the empty stomach, early in the morning, before a meal, was always neutral.[3]

[1] Dunglison's 'Human Physiology,' seventh ed., vol. i, pp. 585 6.

[2] 'Philadelphia Med. Examiner,' July and Sept., 1856, and 'Brit. and For. Med.-Chir. Rev., Jan, 1857, p. 241.

[3] See References in Table; also Carpenter's 'Principles of Human

4. One observation, which has been made in all these cases, has been confirmed in Catherine Ross. This is the non-acidity of the fluid obtained from the empty stomach. No other experiments have been undertaken upon her. As far as regards the size of the opening, no case could be more favorable for examining the interior of the stomach, or for introducing or removing food. Indeed, it would not be a difficult matter, by means of an elastic catheter, to draw off the contents of the duodenum for examination. The patient, however, is in such a debilitated state of health—bed-ridden for nine years and unable to stand, that it has been feared that any observations made on the properties of her gastric juice would at present be of small value. In addition to this, Catherine Ross's propensity to practise deceit would require careful vigilance on the part of the experimenter. In reference, however, to her general health, it may be observed, that since she has been under Dr. Keith's observation, she has gained considerably in flesh and strength; and if she could only be induced to get up and go about, the infatuated act of this poor woman might yet prove a benefit to science.

Physiology, fifth ed., p. 81. The analysis, as given by Dr. Carpenter, does not agree with the original.